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A FRESH LOOK AT FLOORING COSTS. A REPORT ON A SURVEY OF USER EXPERIENCE COMPILED BY ARMSTRONG CORK COMPANY.

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Survey information based on actual flooring installations in several types of buildings and traffic conditions, representing nearly 113 million square feet of actual user experience, is contained in this comprehensive report compiled by the Armstrong Cork Company. The comparative figures provided by these users clearly establish that--(1) the average installed cost of carpeting is 3.6 times higher than the installed cost of an average of six different types of resilient floors, (2) the service life of carpet is less than half that of resilient floors, (3) maintenance costs of carpeted floors are almost double the maintenance costs of resilient flooring, and (4) the "annual use cost," which includes installed costs, service life, and maintenance costs, is 2.71 times higher for carpet than for resilient flooring. A review of this survey should be made by those involved in selection of interior finish materials for commercial, industrial, or institutional construction. (RK)

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A FRESH LOOK AT FLOORING COSTS

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FOREWORD

In recent years, increased attention has been given to the use of carpet in commercial, institutional, and educational building areas where resilient floors have been the traditional choice. The American Carpet Institute has generated much of the interest with a booklet entitled, *Cutting Costs with Carpet.*

In this booklet, the ACI concedes that the original cost of carpet substantially exceeds the cost of resilient floors. However, the ACI study concludes that carpet is so much less costly to maintain that, when initial costs and maintenance costs are amortized over the service life of the material, carpet's "annual cost" is 40.7% to 47.6% *lower* than non-carpeted floors.

Although Armstrong laboratory data sharply contradict the ACI claims, the Company has avoided public discussion of the issue, preferring to let the record on resilient flooring maintenance speak for itself. However, as questions from architects, school administrators, contractors, and the financial community became more numerous, the Company felt obliged to provide answers.

Recognizing that clinical data are inadequate in light of the many variables which affect an individual maintenance situation, the Company determined that the cost experience of users would be the most reliable measure of the comparative costs of the two product types. However, it became quickly apparent that not enough hard data were available to provide a statistically projectable base for a study of user experience. The attitude of many users was that detailed maintenance

cost data were not worth the time and trouble of collecting, since experience had shown resilient floors to be less expensive to maintain. Where maintenance cost data did exist, building owners were frequently unwilling to make it available for use in a comparative cost study since they were reluctant to be drawn into a controversy.

As a result, it was impossible to establish as truly a random sample for the Armstrong Survey of User Experience as originally planned, since the sample was limited by those sources who had cost data and were willing to release it. The resulting data reported in this book are, however, more broadly based than the ACI report in terms of the amount of flooring studied; they are geographically representative of most sections of the United States; and they cover most types of commercial, educational, and institutional buildings. They represent the initial report of a continuing study of flooring maintenance costs.

It is generally not the nature of this Company to make a direct repudiation of a competitive product claim, preferring instead to permit the reputation and experience of its products to speak for themselves in a fair and objective specifying situation. However, in this case, the issue has become so clouded, that Armstrong felt it necessary to present a point-by-point analysis of the ACI study and a comparison of its claims with the experiences of maintenance supervisors across the country.

In contradicting the ACI claims for the costs of carpet, Armstrong does not suggest that carpet has no place in commercial, institutional, or educational buildings. The Company recognizes that carpet is often desirable for certain building areas, such as executive offices.

However, the data in this report present a detailed analysis showing that *carpeted floors cost more to install and maintain than resilient floors.*

The prudent building owner or school administrator, therefore, must be prepared to face the fact that the selection of carpet cannot be rationalized on the basis of its economy.

HOW THE STUDY WAS MADE

FIG. 1 / **SCOPE OF COMPARATIVE STUDIES**

AMERICAN CARPET INSTITUTE

SURVEY OF USER EXPERIENCE

Detailed interviews were conducted in major cities including Philadelphia, Baltimore, Cincinnati, New York, Detroit, New Orleans, Washington, D. C., and Seattle. Respondents were building managers, school administrators, and maintenance engineers representing schools, universities, insurance companies, banks, utilities, hotels, apartments, and large corporations. The purpose of the interviews was to obtain reliable information on installed cost, service life, maintenance labor costs, and equipment and supplies costs for both carpeted and non-carpeted floors.

When all interviews were completed, each was evaluated on the basis of three requirements to determine if that respondent could be appropriately included in the study. The requirements were:

1. The respondent must be responsible for the maintenance of resilient flooring or carpet in areas large enough for data to be representative of maintenace costs as they exist in actual practice across the country.

RESILIENT (SQUARE FEET)	CARPET (SQUARE FEET)
1,000,000*	400,000
112,796,000	**572,000**

*Includes some terrazzo

The ACI figures are based on the study of "well over 1,000,000 square feet" of non-carpeted floors, including both resilient and terrazzo. Carpeted floors in the ACI study totaled 400,000 square feet. The User Experience data in this report are based on 112,796,000 sq. ft. of resilient flooring and 572,000 sq. ft. of carpet. (Figure 1)

2. The respondent must be able to furnish reliable and documented data regarding his maintenance program, techniques, and costs.

Rather than establish theoretical maintenance schedules measured against arbitrary levels of maintenance, Armstrong felt that the most realistic information could be obtained by asking large users of both types of flooring to provide data based on actual costs of actual maintenance programs. In this way the theoretical response is avoided in favor of data more representative of actual maintenance practices.

3. The respondent must use an internal maintenance crew as opposed to contracting the maintenance of his building to an outside maintenance firm.

Data supplied by contract maintenance firms generally reflect *prices, not costs,* and are therefore not pertinent.

SUMMARY OF THE SURVEY OF USER EXPERIENCE

FIG. 2 / **FLOORING MAINTENANCE COSTS**

AMERICAN CARPET INSTITUTE

SURVEY OF USER EXPERIENCE

In comparing costs of carpet and resilient flooring, the American Carpet Institute concedes that resilient floors offer the building owner or school administrator lower installed cost and longer service life than carpet. Yet, the ACI states that resilient floors cost more than three times as much as carpet to maintain and, therefore, carpet's Total Annual Use Cost is as much as 47.6% less than a similar cost for resilient floors.

Total Annual Use Cost, as determined by the ACI, is derived as follows: service life for each flooring product is divided into its installed cost to obtain the annual material cost. To this is added the annual cost of maintenance labor, equipment and supplies, and an allowance for the maintenance and repair of equipment. The final comparative figure is Total Annual Use Cost.

This report contains a detailed analysis of the data on which the ACI bases its claim for lower maintenance costs of carpet. It shows that the ACI claim is based upon calculations which tend to maximize costs for resilient flooring while minimizing costs for carpet. For example:

(a) While the ACI concedes advantages in installed cost and service life to resilient floors, the extent of its concessions appears to be designed to minimize carpet's disadvantage in these two areas.

(b) Costs assigned to resilient floors by the ACI for maintenance labor are inflated by the use of unrealistically high time rates for certain individual maintenance operations, unnecessary frequency of some operations, and

INSTALLED COST SQ. FT.		SERVICE LIFE (YEARS)		ANNUAL MATERIAL COST 1,000 SQ. FT.		MAINTENANCE LABOR COST 1,000 SQ. FT.		EQUIPMENT & SUPPLIES COST 1,000 SQ. FT.		TOTAL ANNUAL USE COST 1,000 SQ. FT.	
RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET
$.55	$1.20	18.0	12.0	$30.60	$100.00	$230.97	$70.10	$59.32	$12.31	$320.89	$182.41
.42	1.53	20.5	9.9	20.63	154.24	109.00	230.00	19.00	18.00	148.63	402.24

duplication of individual operations which are a part of the overall maintenance program for resilient floors. Maintenance labor costs are the key to the ACI claim of lower maintenance costs for carpet and are discussed in detail on Page 13 of this report.

Figure 2 shows the comparison of the ACI data with the Armstrong Survey of User Experience for each step in the development of Total Annual Use Cost. Specifically, the survey reveals that:

1. The average installed cost of carpeting is *3.64 times as high as* the installed cost of an average of six different types of resilient floors. Whereas the ACI concedes an advantage of 65¢ per square foot to resilient floors, the advantage is actually $1.11 per square foot.

2. The service life of carpet is *less than half* that of resilient floors . . . an advantage to resilient floors of more than 100% in contrast to the 50% which the ACI concedes.

3. Maintenance costs of carpeted floors (labor, equipment, supplies, and allowance) are *almost double* the maintenance costs of resilient flooring . . . in contrast to the ACI claim that vinyl-asbestos tile costs more than 3½ times as much as carpet to maintain.

4. The Total Annual Use Cost of carpet is *2.71 times as high as* the Total Annual Use Cost of resilient floors . . . in contrast to the ACI claim that carpet costs are 40.7% to 47.6% lower.

It may appear that the conflicting results of the two studies shown in Figure 2 simply add further confusion to an already confused issue. However, this report provides a detailed analysis of how the results of both studies were developed and computed and offers the reader an opportunity to judge for himself which results are more valid.

ANNUAL MATERIAL COST

(All information in the following comparative study relating to ACI claims is taken from the ACI study as published in *Cutting Costs with Carpet* and will be confined to ACI data on vinyl-asbestos tile. Vinyl-asbestos is not only the most widely used commercial resilient flooring, but also represents a median cost of the three resilient floors included in the ACI study: asphalt tile, vinyl-asbestos tile, and vinyl tile.)

FIG. 3 / **INSTALLED COST (SQ. FT.)**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	$.55*	$1.20
SURVEY OF USER EXPERIENCE	.42**	1.53

*Vinyl-asbestos tile.

**Average of asphalt tile, vinyl-asbestos tile, vinyl tile, rubber tile, Linotile, and linoleum.

For purposes of simplified comparison, the results of the Armstrong study are compiled according to the formula used by the ACI.

In this formula, installed cost is amortized over the service life of the material to obtain the annual material cost per thousand square feet. To this is added annual maintenance labor cost, maintenance supplies cost, annual equipment cost, and an allowance for maintenance and repair of equipment. The result is the final comparative figure: Total Annual Use Cost per thousand sq. ft.

1. INSTALLED COST

User experience shows carpet costs are 3.64 times as high as resilient.

The installed cost of various flooring materials should be the least controversial, since costs for various grades of resilient floors and carpets are well publicized and generally well known. Figure 3 shows the comparison of installed costs in both the Armstrong and ACI studies. The installed cost of $.55 per sq. ft. is listed by the ACI as an average cost for vinyl-asbestos tile, whereas the $.42 figure reported in the Armstrong study is an average cost figure for 112,796,000 sq. ft. of resilient floors which include asphalt tile, vinyl-asbestos tile, vinyl tile, rubber tile, Linotile®, and linoleum.

The installed cost of vinyl-asbestos tile should range from 25¢ to 45¢ per sq. ft. depending upon gauge and design selected (1). In a survey of flooring contractors across the nation it was found that, under competitive bidding situations in jobs of 20,000 sq. ft. or more, ⅛" straight grain vinyl-asbestos tile averaged 28¢ to 30¢ installed. As a result, it would appear that 55¢ per sq. ft., used by the ACI as an *average* for vinyl-asbestos tile, is not in accord with actual competitive market conditions.

The ACI did not identify the type of carpet used as the basis for its study. However, one might question whether a good grade of commercial carpet can be installed with padding at the ACI figure of $1.20 per sq. ft. ($10.80 per sq. yd.). In a chart published by one carpet manufacturer (2) various types of

(1),(2) See Bibliography, Page 29

FIG. 4 / **CARPET COSTS AT IBM**

	TRAFFIC	LEVEL OF MAINTENANCE	INSTALLED COST SQ. FT.	SQ. YD.
EXECUTIVE OFFICES	LIGHT	HIGH	$4.386	$39.47
CONFERENCE ROOMS	HEAVY	HIGH	3.09	27.81
PRIVATE OFFICES	MEDIUM TO HEAVY	HIGH	1.53	13.77

carpet are listed with suggested applications and prices. Carpets recommended for school use, for example, ranged in price from $14 to $30 per sq. yd. for carpet *only* (not including pad or installation), and the *average* cost was $19.68. Carpets recommended for office buildings ranged from $11 to $30 per sq. yd. and averaged $18.78 without pad or installation.

The following have been cited by carpet distributors for average installed costs of commercial carpet (3): "Crown Floors, New York, $12.50 per yard; Newell, Orr & Walsh, New York, $13.50 to $15 per yard; contract division of Carson, Pirie Scott & Co., Chicago, $12 to $14. . . ."

Mr. Herman Grau, Jr. (4), of IBM sheds some additional light on the subject of installed costs of carpet (Figure 4). In a study of the comparative cost of carpet and resilient floors, Mr. Grau reported carpet costs ranging from $13.77 per yard to $39.47 per yard. His lowest cost carpet ($13.77) was 27.5% higher than the ACI's average cost figure of $10.80.

2. SERVICE LIFE

Survey shows carpet offers less than half the service life of resilient.

The service life of carpet and resilient floors depends upon many variables such as the amount of traffic to which the floor is subjected, the quality of the material, how it is maintained, and one's own definition of what is "worn out." The User Experience Survey reports average service life to be 20.5 years for resilient floors and 9.9 years for carpet. (Figure 5) This is in contrast to the ACI claim of 18 years and 12 years for resilient floors and carpet respectively. The consensus of other sources is that the ACI claim of 12 years for carpet is high.

IBM's Mr. Grau lists five years as the service life of carpeting costing as much as $39.47 per yard.

(3),(4) See Bibliography, Page 29

FIG. 5 / **SERVICE LIFE (YEARS)**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	18.0	12.0
SURVEY OF USER EXPERIENCE	**20.5**	**9.9**

FIG. 6 / **ANNUAL MATERIAL COST (1,000 SQ. FT.)**

	RESILIENT	CARPET	ADVANTAGE TO
AMERICAN CARPET INSTITUTE	$30.60	$100.00	RESILIENT—$69.40
SURVEY OF USER EXPERIENCE	**20.63**	**154.24**	**RESILIENT—133.61**

BUILDINGS (3), one of the leading magazines in the building management field, says: "From their records, a large life insurance company cites a range of carpet wearability between eight and ten years, and less than eight in areas of hard use. Crown Floors of New York contends that even a good grade of carpet will last little more than seven years under medium heavy traffic conditions. And a representative of Hercules Floors in New York said, 'I don't know of any carpet that will get over ten years of wear in a corridor.' "

On the other hand, it is not unusual for resilient floors to offer a service life of twenty to thirty years or even longer. Mrs. Jane Leonard, Housing Manager of a large western university, says, "We have some resilient floors in excellent shape after 32 years. They may last even longer with good care."

A large eastern insurance company recently replaced its old linoleum floor with 300,000 feet of rubber tile. The linoleum's life was 30 years, and it gave, says Mr. LeRoy E. Varner, Manager of the company's Engineering Division, "remarkable service."

A recent article in *American School & University*(5) contained two comments which indicate that resilient flooring is equally serviceable in public schools.

Says Mr. Walter Spurgeon, construction expediter, Dayton, Ohio, public schools, " 'We've had our vinyl-asbestos down for 12 years, and it looks great. I think it should last for more than 25 years.'

" 'Some of our asphalt tile floors are 30 years old, and they still look good,' says James L. Theodores, administration assistant in charge of buildings and grounds, Scarsdale, New York, public schools."

The service life of carpeting appears to depend upon the grade of carpet purchased initially and the care with which it is maintained. It is conceivable that carpet in the $18 to $20 range, as recommended by Gulistan, (2) could last the twelve years the ACI claims if it is carefully maintained. However, careful maintenance of carpet is also expensive maintenance. Mr. Greer Heindel, President of Building Maintenance, Inc., Cynwyd, Pennsylvania, has stated that low-cost carpet (of the type used for ACI's cost comparison) could be maintained for the low amount ACI

(3),(5),(2) See Bibliography, Page 29

FIG. 7 / **COMPARISON SUMMARY**

	INSTALLED COST (SQ. FT.)		SERVICE LIFE (YEARS)		ANNUAL MATERIAL COST (1,000 SQ. FT.)	
	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	$.55	$1.20	18.0	12.0	$30.60	$100.00
SURVEY OF USER EXPERIENCE	.423	1.527	20.5	9.9	20.63	154.24

claims if traffic lanes were vacuumed two to three times per week, with complete vacuuming once a week and shampooing every year or two. However, he says that the carpet maintained in this manner would survive only a few years, because dirt retained in the pile of a carpet is ground into the carpet fibers and seriously reduces the carpet's life expectancy.

Indeed, the ACI itself says,(6) "Of course, no carpet can deliver maximum performance without care. Premature wear usually results from improper maintenance. To permit gritty abrasive materials to remain in a carpet causes it to abrade and wear. Also, if certain types of spots are not removed within a reasonable length of time, they can cause deterioration."

(6) See Bibliography, Page 29

3. ANNUAL MATERIAL COST (1,000 SQ. FT.)

Advantage to resilient floors almost twice what ACI reports.

The differences in installed cost and service life between the Armstrong and ACI studies become more significant when these figures are amortized over the life of the floor. (Figure 6) The advantage which the ACI concedes to resilient floors is $69.40 per thousand sq. ft. (the difference between $100 for carpet and $30.60 for resilient). In the Armstrong study, this difference in annual cost jumps to $133.61 ($154.24 for carpet minus $20.63 for resilient).

Figure 7 presents a summary of Figures 3, 5, and 6 and brings to light the first step in the statistical process by which the ACI ultimately suggests that carpet is less expensive than resilient flooring. While conceding an advantage in annual material cost to resilient flooring, the ACI concedes just enough to place its figures within the realm of possibility.

As may be seen in the complete cost breakdown in Figure 17 on Page 25, ACI cost figures for carpet are the lowest of any of the other sources. Similarly, ACI costs for resilient floors are consistently higher than resilient costs reported by the other sources. As a result, it appears that the ACI, forced to yield an advantage to resilient floors, has selected figures which minimize this advantage.

MAINTENANCE LABOR COSTS

NOTE: In reviewing the entire question of comparative maintenance costs, it will be important to keep in mind that the ACI figures are based on a study of unobstructed corridors. Data in the Armstrong study and other sources referred to in this report, however, are based on average maintenance costs in both unobstructed and obstructed areas. ACI cost data should, therefore, be lower than data from other sources because obstructed areas require more cleaning time due to the amount of time involved to move or work around desks and other furniture.

It is generally conceded that labor is the largest single item in the maintenance cost of any type of flooring. Most experts consider labor to represent 85% to 95% of total maintenance cost, the remaining 5% to 15% being applied to: maintenance supplies such as cleaners, finishes, etc.; maintenance equipment such as vacuum machines, buffers, brooms, mops, etc.; and an allowance for maintenance and repair of equipment. Since labor costs are such a significant factor, the Armstrong Survey of User Experience devotes its greatest attention to this facet of maintenance cost.

MANY VARIABLES AFFECT COSTS; BROAD-BASED AVERAGE IS BEST GUIDE.

There are so many variables affecting maintenance costs that it is virtually impossible to find any degree of consistency. In the Armstrong study, maintenance labor costs ranged from 2.1¢ to 40¢ per sq. ft. Yet in most cases, these wide variances are most understandable because of the variables involved:

LOCATION—A given flooring material in a well-traveled corridor will require more frequent maintenance than the same floor in a private office.

On the other hand, a given maintenance operation will take more time in an office or classroom than in a corridor because of the time required to move or work around furniture.

TRAFFIC—Depending upon the size and type of the building, the same location in two different buildings can receive vastly different levels of traffic.

LEVEL OF MAINTENANCE DESIRED—This is a very personal thing. Some companies demand extremely high levels of floor maintenance while others are content with the appearance resulting from a low-cost minimum maintenance program. And there are infinite variations between these extremes.

COLOR AND DESIGN OF FLOORING—Certain colors and designs, which tend to show soil more readily than others, require more care in order to achieve the desired level of maintenance and therefore have higher maintenance costs.

QUALITY OF FLOORING MATERIAL—Generally speaking, the higher quality products in both carpet and resilient flooring will be less expensive to maintain.

LABOR RATES—Average hourly wage rates (7) for janitors vary from city to city from a low of $1.18 per hour in New Orleans to a high of $2.43 in Akron, Ohio. As a result, one can find an almost unbelievable disparity in costs for the same maintenance operation in two different geographic areas. For example, assume a program of maintenance which calls for 125 hours per thousand square feet per year.

In New Orleans, this maintenance program would cost $147.50 per thousand sq. ft. per year. In Akron, the same maintenance program would cost the building owner $303.75 per thousand sq. ft. per year.

MAINTENANCE SCHEDULES AND METHODS—How often each maintenance task is performed and the method used have the most direct bearing on maintenance costs. This is a reflection of the individual needs of the building as determined by the six variables previously listed and is discussed in detail in the following section.

Because of the many variables involved, it is virtually impossible to find any two users with identical cost figures. Therefore, it is certain that no single set of maintenance cost data can be considered final and absolute. The best guide can be no more than averages, broadly based on actual user experience, which will provide an indication of what any one building owner or school administrator might expect to experience under his own individual set of circumstances.

(7) See Bibliography, Page 29

FIG. 8 / **MAINTENANCE LABOR COSTS (1,000 SQ. FT.)**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	$230.97	$ 70.10
SURVEY OF USER EXPERIENCE	109.00	230.00

MAINTENANCE LABOR COSTS FAVOR RESILIENT FLOORS.

Figure 8 shows the comparative annual maintenance labor costs from both the ACI study and the Armstrong Survey of User Experience. Whereas the ACI reports labor costs of $230.97 per 1,000 sq. ft. for resilient floors and $70.10 per 1,000 sq. ft. for carpet, the Survey of User Experience reports $109.00 for resilient floors and $230.00 for carpet.

In order to verify its position, Armstrong compared its results with labor costs reported by IBM (4), the Bell System (8), the National Sanitary Supply Association (9), and the Asphalt and Vinyl Asbestos Tile Institute (10). Figure 9 puts the Armstrong/ACI comparison in perspective.

Because of the seven variables listed earlier, there is no reason to expect all sources to come up with the same set of figures. However, *it is significant that only in the case of the ACI study does carpet enjoy a lower maintenance labor cost than resilient floors.* In all other cases, carpet costs exceed resilient costs by 35.6% to 111.0%.

UNREALISTIC MAINTENANCE PROGRAM BASIS FOR ACI CLAIM OF HIGH RESILIENT COSTS.

The reasons for the sharply varying opinions between the ACI and the other five sources in Figure 9 may be found by a careful examination of the maintenance schedule (Figure 10) on which the ACI bases its claim of higher maintenance costs for resilient flooring (6). Compared with it is the maintenance program outlined by the National Sanitary Supply Association in its "Maintenance Planning Workbook" with corresponding time rates taken from the organization's "Area Cleaning Time Calculator". (NSSA data appear to be especially pertinent since this 42-year-old association of 1,275 manufacturers and distributors of janitors' supplies, chemicals, and equipment is most active, and widely respected, in the field of maintenance education. NSSA established the Institute of Sanitation and Modern Cleaning Methods to provide educational information on public health problems and sanitation ordinances, provides a home study course for custodians, and publishes a variety of documents on maintenance subjects.)

(4),(8),(9),(10),(6) See Bibliography, Page 29

FIG. 9 / **MAINTENANCE LABOR COSTS (1,000 SQ. FT.)**

	RESILIENT	CARPET
NSSA*	$192.50	$261.07
AVATI**	70.14	—
IBM	166.00	256.00
BELL SYSTEM	87.80	113.30
AMERICAN CARPET INSTITUTE	230.97	70.10
SURVEY OF USER EXPERIENCE	109.00	230.00

*NSSA does not publish actual cost figures. These costs were computed by taking the maintenance program and number of annual hours required to maintain each type of floor, as presented in NSSA's *Maintenance Planning Workbook*, and *Area Cleaning Time Calculator*, and multiplying annual hours by a labor cost of $1.75 per hour. $1.75 is the hourly wage used to compute maintenance costs by the ACI in *Cutting Cost with Carpet*. The NSSA program is based on a six-day week. However, the costs were adjusted to a five-day week, since this was the basis of the ACI study.

**Carpeted floors were not included in AVATI study.

Figure 10 reveals four major areas in the ACI program which are not typical of good maintenance practice and which inflate resilient flooring maintenance costs: (A) the schedule of maintenance operations, (B) the duplication of operations within a given period of time, (C) the time rate, or number of minutes, required for each operation, and (D) the frequency with which each operation should be performed. Since these four points are the key to the ACI claim for higher resilient flooring maintenance costs, they deserve closer examination.

A. THE SCHEDULE OF MAINTENANCE OPERATIONS.

Practical maintenance programs do not include each of the six operations included by the ACI in Figure 10. For example, spray buffing* is a relatively new development in floor maintenance and is not included in many maintenance programs at this time. Instead, periodic light cleaning and re-waxing with the traditional mop and buff technique is used. When spray buffing is included in the maintenance program, it is generally used as a technique for spot cleaning or periodic cleaning of heavy traffic areas. As a result, it is not regularly scheduled but is performed on an "as needed" basis when damp mopping is no longer effective in removing embedded soil and black marks.

Since reconditioning (defined by ACI as damp mopping and buffing while damp) is basically a duplication of spray buffing, it would be most unusual to find any maintenance program that includes both operations on a regularly scheduled basis. Therefore, either the 1,170 minutes for reconditioning in Figure 10 or the 1,560 minutes for spray buffing should be subtracted from the total annual minutes required to maintain a resilient floor.

Similarly, dry buffing is not a valid addition to every maintenance program since it would not be included if a self-polishing, polymeric finish were used on the floors. On application, this type of polish dries to a high gloss without buffing and does not respond well to dry buffing.

*Spray buffing involves the use of a combination solution of water, polish, and floor cleaner. The solution is sprayed over the soiled area and is immediately buffed to dryness. It performs the function of light-duty cleaning and a light reapplication of polish in the same operation.

FIG. 10 / **A COMPARISON OF MAINTENANCE SCHEDULES, CLEANING RATES, AND FREQUENCIES FOR RESILIENT FLOORS**

DUST MOP
DAMP MOP
WET MOP AND RINSE*
DRY BUFF
STRIP AND REFINISH
SPRAY BUFF
RECONDITION**
CLEAN AND RECOAT***

B. DUPLICATION OF OPERATIONS

The ACI maintenance program for resilient floors does not acknowledge that certain operations are eliminated from the daily or weekly schedule when other operations are scheduled for the same day or week.

For example, the ACI schedules damp mopping as a weekly operation, charging costs to resilient floors based on damp mopping 52 times per year. Yet damp mopping would not be necessary in the same weeks that reconditioning or stripping and refinishing are scheduled. Since these latter operations are performed a combined total of 32 times, damp mopping would be limited to only 20 weeks, rather than the 52 weeks charged to resilient flooring maintenance in the ACI chart. (Figure 10)

Similarly, one would not dry buff the six weeks in which stripping and the 26 weeks in which reconditioning are scheduled. Annual costs for dry buffing would then be based upon 20 weeks per year rather than 52 and on only 400 annual minutes (20 times per year times 20 minutes per operation) instead of the 1,040 minutes included in the ACI costs.

By eliminating duplication in these operations, the ACI annual minutes per 1,000 sq. ft. have been reduced as follows:

Dust Mop		1,300		1,300
Damp Mop	from	1,040	to	400
Dry Buff	from	1,040	to	400
Spray Buff	from	1,560	to	0
(eliminated; duplicates reconditioning*)				
Recondition		1,170		1,170
Strip and Refinish		1,800		1,800
TOTAL	from	7,910	to	5,070

Because of unnecessary duplication in its cost data for damp mopping, dry buffing, and spray buffing, the ACI charges resilient flooring maintenance with the cost of 7,910 annual minutes . . . 2,840 minutes or 56% higher than the unduplicated total of 5,070 minutes.

*A similar comparison could be made by retaining spray buffing in the maintenance program and eliminating reconditioning. However, both operations would rarely be included in the same maintenance program since they involve simply two different techniques for performing the same maintenance function: light-duty cleaning and polishing.

RATE (MINUTES) 1,000 SQ. FT.		ANNUAL FREQUENCY		ANNUAL MINUTES 1,000 SQ. FT.	
ACI	NSSA	ACI	NSSA	ACI	NSSA
5	15	260	260****	1,300	3,900
20	—	52	—	1,040	—
—	35	—	40	—	1,400
20	—	52	—	1,040	—
300	150	6	2	1,800	300
30	—	52	—	1,560	—
45	—	26	—	1,170	—
—	100	—	10	—	1,000
			TOTAL	7,910	6,600

*The NSSA maintenance program for resilient floors recommends, "wet mop and rinse," rather than damp mop. This is a more thorough cleaning operation which, because it involves two separate cleaning steps, requires more time than damp mopping.

**Reconditioning is defined by the ACI as "damp mopping and buffing while damp."

***"Clean and Recoat" is not included in the ACI schedule for resilient flooring maintenance. It is added here for purposes of comparison since it is an integral part of the NSSA maintenance program.

****NSSA program is based on a six-day week. In order to present a fair comparison, the figures assigned to NSSA costs were adapted to a five-day week, on which the ACI figures are based.

The difference of 2,840 minutes reduces actual costs of resilient flooring maintenance by $82.83. (2,840 minutes ÷ 60 equals 47.33 annual hrs. times $1.75 per hr.)

The ACI study assigns vinyl-asbestos tile with a cleaning labor cost of $230.97, based on the maintenance program in Figure 10. Just by eliminating duplication of three operations, this cost figure is reduced from $230.97 to $148.14.

C. RATE FOR EACH MAINTENANCE OPERATION

Most noteworthy here is that the ACI rate of 300 minutes per 1,000 sq. ft. for stripping and refinishing is twice the generally accepted rate for this operation. BUILDINGS Magazine's Handbook of Building Operations(11) offers the following time standards for stripping and refinishing: unobstructed areas—100 minutes per 1,000 sq. ft.; slightly obstructed—120 minutes; obstructed—140 minutes; heavily obstructed—150 minutes.

D. FREQUENCY OF MAINTENANCE OPERATIONS

Few sources recommend stripping and refinishing more than twice each year. NSSA recommends semiannual stripping. BUILDINGS Magazine(11) says, "Unless subjected to unusual amounts of soil, they (resilient floors) require thorough scrubbing or wax stripping only once or twice per year." In fact, some custodians never completely strip their floors. An article in *American School & University*(5) reports: "Although there are some custodians who refuse to budge from standard cleaning methods, others have found such things as stripping unnecessary. 'Vinyl-asbestos tile is easily cleaned with the spray-buff method, and we think it may not need any finish at all,' says Michael W. Critch, supervisor of custodians, Newton, Massachusetts, public schools. 'Instead of stripping our vinyl-asbestos floors, we lightly scrub and refinish once—in the summer. The floors look perfect.' So commented Albert Tarrant, director of buildings and grounds, Darien, Connecticut. On some school floors, vinyl-asbestos tiles stay bright with little more than buffing. Such is the case in many Cincinnati schools, according to Joseph Beckman, assistant superintendent."

In contrast, the ACI costs for resilient flooring are based on stripping and refinishing every two months. (Figure 10)

(11),(5) See Bibliography, Page 29

FIG. 11 / **A COMPARISON OF MAINTENANCE SCHEDULES, CLEANING RATES, AND FREQUENCIES FOR CARPET**

SPOT VACUUMING (TRAFFIC LANES)

COMPLETE VACUUMING—WAND-TYPE VACUUM

COMPLETE VACUUMING—UPRIGHT VACUUM

STAIN REMOVAL

PILE LIFTING

WET CLEANING WITH SHAMPOO SOLUTION

DRY CLEANING WITH DRY SHAMPOO POWDER

Few maintenance authorities recommend spray buffing on a weekly basis, preferring instead to schedule it only when damp mopping is no longer adequate in removing soil (approximately every two months). Yet the ACI costs for resilient floors include the cost of spray buffing 52 times per year.

In addition, the frequency with which various operations need to be performed will also depend to a large extent on which of the three basic types of polish are employed in the maintenance program: a wax, a finish, or a buffable finish. A wax-type polish will be dry buffed almost twice as often as a buffable finish, while a self-polishing polymeric finish usually will not be buffed at all. Similarly, damp mopping is required more often on a softer, wax-type polish than on a harder polymeric finish. And since a polymeric finish cannot be adequately restored by buffing, it will require more frequent cleaning and recoating than a wax or buffable finish. As a result, the ACI claims for frequency of each maintenance operation do not stand up under close scrutiny.

These four areas of disagreement suggest the reason for the high costs of maintaining resilient floors in the ACI study: ACI data include maintenance operations that are not generally considered an integral part of all maintenance programs, such as spray buffing and reconditioning; ACI data are based upon unnecessary duplication of operations; ACI time rates for certain operations far exceed generally accepted rates; i.e., 300 minutes vs. 150 minutes stripping and refinishing; ACI frequencies of operations exceed generally accepted levels; i.e., stripping and refinishing six times annually rather than only twice.

RATE (MINUTES) 1,000 SQ. FT.		ANNUAL FREQUENCY		ANNUAL MINUTES 1,000 SQ. FT.	
ACI	NSSA*	ACI	NSSA	ACI	NSSA
5.19	22.00	208.00	208**	1,079.5	4,576.0
8.98	—	26.00	—	233.5	—
18.00	70.00	26.00	50	468.0	3,500.0
4.13	4.13	52.00	52	214.8	214.8
20.00	20.00	3.00	3	60.0	60.0
240.00	300.00	.50	2	120.0	600.0
180.00	—	1.25	—	225.0	—
			TOTAL	2,400.8	8,950.8

*Note that the NSSA time rates are considerably higher than the ACI rate for the same operations. This is due to the fact that the NSSA rates are based on average times to clean both unobstructed areas such as corridors and obstructed areas such as offices and classrooms. Obstructed areas require considerably more cleaning time because of time required to move or work around desks and other furniture. The lower ACI rates are based on cleaning times for unobstructed corridors, as are all ACI data referred to in this report.

**NSSA program is based on a six-day week. In order to present a fair comparison, the figures assigned to NSSA costs were adapted to a five-day week, on which the ACI figures are based.

CARPET MAINTENANCE COSTS SIGNIFICANTLY HIGHER THAN ACI CONCEDES

Inconsistencies similar to those appearing in the preceding section on resilient flooring maintenance are again present in a comparison of schedules, rates, and frequencies for carpet maintenance. (Figure 11)

The comparison between ACI and NSSA annual minutes of carpet maintenance suggests that carpet requires *almost four times as much maintenance time* as the ACI study reports. The chief areas of disagreement:

(a) The time required for vacuuming. NSSA time rates for this operation are considerably higher because they average vacuuming time for both obstructed and unobstructed areas, whereas the ACI rate is based on vacuuming unobstructed corridors. (See footnote to Figure 11.) Since a carpeted school or office building would have more obstructed areas (offices or classrooms) than unobstructed corridors, the NSSA rates could be considered more pertinent.

(b) The frequency of wet cleaning. ACI says every two years; NSSA says semiannually. A third source (12) states, "Although there is no set rule governing how often a carpet must be wet shampooed, it is fairly certain that at least one yearly cleaning will be required." It appears that the very fact that carpet must be cleaned presents additional problems. Says Mr. Jack Ewing of Pacific Telephone and Telegraph Company, (8) "Carpets are not easily cleaned in place. Cleaning residues remain after shampooing which accelerate resoiling. The more frequently it is cleaned, the shorter the intervals between shampooing. If done improperly, the carpet can shrink or mildew. There is a 'down time.' While the carpet is damp, it cannot be walked on. Eventually, it must be taken up, sent out, and cleaned at considerable expense."

(12),(8) See Bibliography, Page 29

FIG. 12 / **TOTAL ANNUAL MINUTES REQUIRED TO MAINTAIN 1,000 SQ. FT. OF FLOORING**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	7,910	2,400.8
NATIONAL SANITARY SUPPLY ASSOCIATION	6,600	8,950.8

NSSA figures do not include rates or frequencies for stain removal or pile lifting. Therefore, to present a more realistic comparison, ACI rates for these operations were simply added to the NSSA data in Figure 11.

However, the ACI recommendation for weekly stain removal is open to question. Most sources recommend stain removal on a daily or as-needed basis. As Mr. Ewing of Pacific Bell Telephone Company (8) points out: "Carpet is readily stained or bleached by many soils encountered in the office. These include pencil leads, ink, carbon paper, rubber cement, office copying machine fluids, ink eradicator, coffee, chewing gum, nail polish, etc. When large amounts of carpet are involved, a man assigned almost completely to stain removal must be constantly available on call. If the stain sets, it will be much harder to remove. These soils are readily removed from resilient floorings."

SUMMARY OF MAINTENANCE LABOR COSTS SHOWS ACI COST DATA UNREALISTIC

It again becomes apparent that all available data from other sources contradict the ACI claim of lower maintenance costs for carpet.

High maintenance labor costs for resilient floors result from the fact that the ACI report did not eliminate unnecessary duplication of maintenance operations from its tabulation of annual minutes. When this duplication is eliminated from the ACI data, resilient flooring

(8) See Bibliography, Page 29

FIG. 13 / **ANNUAL MAINTENANCE LABOR COSTS (1,000 SQ. FT.)**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	$230.97	$70.10
NATIONAL SANITARY SUPPLY ASSOCIATION	192.50	261.07
SURVEY OF USER EXPERIENCE	109.00	230.00

costs drop from the ACI claim of $230.97 to $148.14. This figure could be reduced even further because, as pointed out in Items C and D on Page 18, the ACI maintenance program for resilient floors is based on time standards and frequencies of maintenance operations that are not endorsed by most knowledgeable sources.

Low labor costs for carpet maintenance result from the ACI's sharp deviation from NSSA recommended time rates for vacuuming and wet cleaning.

The extent to which the ACI figures are contradicted by NSSA appears in Figure 12, in which total annual minutes, derived from Figures 10 and 11, are compared. NSSA data indicate that (a) resilient floors require less maintenance time and are therefore less expensive to maintain than the ACI claims, and (b) annual minutes required to maintain carpet exceed the ACI claim by almost four times.

Figure 13 converts annual minutes into annual dollars to compare maintenance labor costs for the Armstrong Survey of User Experience, the ACI study, and the NSSA figures. This is done by dividing annual minutes by 60 to obtain annual maintenance hours and multiplying by an hourly wage rate of $1.75 which was used by ACI to determine its cost data. Once again, it is significant that only the ACI figures show carpet to provide lower maintenance labor costs than resilient flooring.

CAPITAL EQUIPMENT & SUPPLIES COSTS

FIG. 14 / **CAPITAL EQUIPMENT COSTS** RESILIENT FLOORS

	DISTRIBUTOR AVERAGES	ACI
WET PICKUP VACUUM	$341.00	$337.00
FLOOR MACHINE (19")	420.00 (a)	401.25
SCRUB BRUSH	16.00	17.00
BASEBOARD CLEANING MACHINE	(b)	289.00
TWO 32-QT. STAINLESS STEEL MOP BUCKETS	24.00 (c)	98.20
TWO WRINGERS, INDUSTRIAL TYPE	20.00	44.50
	$821.00	$1,186.95

FIG. 15 / **CAPITAL EQUIPMENT COSTS**

	RESILIENT	CARPET
AMERICAN CARPET INSTITUTE	$1,186.95	$859.20
SURVEY OF USER EXPERIENCE	821.00	1,260.45

Since it is generally conceded that labor accounts for 85% to 95% of total floor maintenance costs, the cost of capital equipment and supplies becomes a less significant factor. However, certain incongruities exist in the ACI figures which tend to inflate these costs for resilient flooring and should be explained.

Figure 14 shows how the ACI's Capital Equipment Costs for resilient floors compare with average costs reported by distributors of commercial maintenance supplies.

Three items keyed in this chart deserve closer attention:

(a) The ACI study says, "Floor machines are required for tile maintenance and therefore can be available to be shared with the carpeted areas when shampooing is necessary. Because, however, the floor machine will be used primarily on tiled floors . . . only one-fourth of the cost . . . (of $535) . . . has been charged to carpets and three-fourths ($401.25) to tile." For a bonafide comparison, the full cost of the floor machine should be charged against both carpet and resilient equipment costs, since the same equipment would be required in a building with all carpeted floors as well as one with all resilient floors. ACI uses $535 as the list price of the 19" floor machine with a tank. The same machine without the tank would cost $420. Since the tank is required only for shampooing carpet and is not necessary for maintaining resilient floors, $420 is applied to capital equipment costs for resilient floors and $535 to capital equipment costs for carpet maintenance. (These prices represent list prices. The equipment could actually be purchased for considerably less than these amounts.)

(b) The Armstrong study did not locate any maintenance supervisors who use a baseboard cleaning machine in maintaining resilient floors. The survey of maintenance supplies' distributors revealed that this item is not

FIG. 16 / **ANNUAL EQUIPMENT AND SUPPLIES COST COMPARISON**

	ANNUAL CAPITAL EQUIP. COST		EQUIP. MAINT. & REPAIR ALLOWANCE		MAINTENANCE SUPPLIES		TOTAL ANNUAL EQUIP. & SUPPLIES	
	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET
BELL SYSTEM	$3.06	$6.11	$ .92	$1.83	$12.23	$5.66	$16.21	$13.60
AMERICAN CARPET INSTITUTE	7.42	5.37	2.23	1.61	49.67	5.33	59.32	12.31
USER EXPERIENCE & DISTRIBUTOR AVERAGES	**5.13**	**7.88**	**1.54**	**2.36**	**12.33**	**7.76**	**19.00**	**18.00**

in widespread use. Says BUILDINGS, (13) "According to Alan Motz, this machine has never been a part of National Cleaning Contractor's equipment supply (and National cleans 65 million sq. ft. of floor space every night)." Therefore, the cost of the baseboard cleaning machine has been eliminated.

(c) Two 32-qt. stainless steel mop buckets and "two wringers, industrial type" are listed in the ACI figures with a combined cost of $142.70. Once again, Armstrong was unable to locate anyone who felt that ordinary galvanized buckets, complete with wringers at a cost of $44, were inadequate. Bill Baker of Chicago Cleaning Contractors says, (13) "We've never bought a stainless steel mop bucket in our 56 years of business."

By eliminating the baseboard cleaning machine, substituting galvanized for stainless steel buckets, and even though charging the full list price of the floor machine, capital equipment costs for resilient floors should be $365.95 or 30.8% *lower* than the costs ascribed to resilient flooring equipment in the ACI study.

The ACI reports capital equipment costs for carpet maintenance of $859.20 based on a ¼ share of the floor machine. However, when the full $535 list price of the floor machine with tank is added to the ACI cost of carpet equipment, the total figure goes from $859.20 to $1,260.45. Therefore, a realistic comparison of equipment costs for each type of floor reveals $821.00 for resilient capital equipment versus the ACI figure of $1,186.95; and $1,260.45 for carpet capital equipment versus the ACI figure of $859.20. (Figure 15)

When these figures are amortized over the life of the equipment, and an allowance is added for maintenance and repair of equipment, the Armstrong Survey of User Experience adds annual cost of maintenance and supplies for each type of product to produce the comparison shown in Figure 16 for Total Annual Equipment and Supplies Cost.

For purposes of comparison, Bell System data (8) have been added to Figure 16. Note that in each of the three cost categories as well as in the total cost for equipment and supplies, the ACI figures are highest for resilient and lowest for carpet than data from the other sources.

(13),(8) See Bibliography, Page 29

TOTAL ANNUAL USE COST

FIG. 17 / **FLOORING MAINTENANCE COSTS** (COMPARISON—ALL SOURCES)

	INSTALLED COST SQ. FT.		SERVICE LIFE (YEARS)		ANNUAL MATERIAL COST 1,000 SQ. FT.		MAINTENANCE LABOR 1,000 SQ. FT.	
	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET	RESILIENT	CARPET
IBM*	$.55	$1.53	10	6	$55.00	$255.00	$166.00	$256.00
NATIONAL SANITARY SUPPLY ASSOC.	—	—	—	—	—	—	192.50	261.07
BELL SYSTEM	.40	1.50	18	12	22.22	125.00	87.80	113.30
ASPHALT AND VINYL ASBESTOS TILE INSTITUTE	.35	—	—	—	—	—	70.14	—
AMERICAN CARPET INSTITUTE	.55	1.20	18	12	30.60	100.00	230.97	70.10
SURVEY OF USER EXPERIENCE	.42	1.53	20.5	9.9	20.63	154.24	109.00	230.00

Total Annual Use Cost is the sum of the cost of the flooring material amortized over its service life, plus costs of maintenance labor, equipment, and supplies. This is the final comparative figure which the ACI suggests should be used as a guide to buying decisions.

Figure 17 recaps all previous cost comparisons, adding the Total Annual Use Cost figure. In contrast to the ACI position that carpet is 43% lower in Total Annual Use Cost than vinyl-asbestos tile, the Armstrong Survey of User Experience finds that carpet costs are more than 2½ times as high as an average of six different types of resilient flooring.

Since perspective is needed to reconcile the sharp contrast between the Armstrong and ACI conclusions, Figure 17 adds Mr. Herman Grau's data experienced at IBM, the results of the Bell System study, and a study of school maintenance costs sponsored by the Asphalt and Vinyl Asbestos Tile Institute.

Once again, while the actual figures vary from source to source, the ACI study is the only one which gives the economic advantage to carpet.

EQUIPMENT & SUPPLIES 1,000 SQ. FT.		TOTAL ANNUAL USE COST 1,000 SQ. FT.	
RESILIENT	CARPET	RESILIENT	CARPET
—	—	$221.00**	$511.00**
—	—	—	—
$16.21	$13.60	126.23	251.90
8.92	—	81.58	—
59.32	12.31	320.89	182.41
19.00	**18.00**	**148.63**	**402.24**

*IBM reported installed costs of carpet to be $1.53, $3.09, and $4.38 per sq. ft. The lowest figure was selected as being a more reasonable basis for comparison. Other IBM figures shown here reflect what appears to be an extremely high level of maintenance.

**Not "total" annual use cost since costs of equipment and supplies are not included in IBM data.

CONCLUSION

It is clear that no one set of cost figures can seriously be claimed to be the ultimate judgment in comparing the cost of carpet and resilient floors. There are too many variables involved for the question ever to be able to be answered in terms of statistical absolutes.

Even the averages presented by the Armstrong Survey of User Experience provide only an indication of what the building owner might expect in terms of costs for one or another of the products involved.

Two definite conclusions, however, can be drawn from this report:

1. Widespread practical experience and recognized authorities both deny that carpet is as economical to install and maintain as resilient floors.

2. Maintenance costs are like fingerprints. No two alike.

It is hoped that this report on the Survey of User Experience will enable the specifier to make objective decisions in the selection of flooring materials on the basis of the true values inherent in each type of product.

ANOTHER QUESTION: THE ACOUSTICAL VALUE OF CARPET

Much has been said in recent years about the ability of carpeting to deaden or eliminate unwanted sound in a room. Some carpet manufacturers have even gone so far as to promote their products as "acoustical floor coverings," in an attempt to gain a foothold in traditionally uncarpeted areas, such as school classrooms, where acoustical environment is always a matter of prime concern.

There can be little argument that carpet does, in fact, provide some acoustical benefit in a room, primarily in the area of deadening impact sounds caused by footsteps and dropped objects. But carpet industry claims now go far beyond the question of impact noise. Today it is claimed that carpeting, per se, is an efficient sound absorber, comparable in performance or even superior to acoustical ceiling tile in the control of airborne noise. It is here that some serious questions must be raised.

Acoustical tile is specifically designed to have physical properties which are conducive to effective sound absorption. These materials, which are generally 5/8" to 3/4" thick, must have a minimum Noise-Reduction Coefficient of .50 to be recognized as an acoustical material; most products on the market far exceed this minimum, reaching N.R.C. values as high as .80 or .90.

For a carpet-pad combination to be equally effective, it must be of equal thickness and have basic physical properties which are equally conducive to effective sound absorption. This means that it must have a high degree of porosity, be open-celled, and have suitable air-flow characteristics (no impermeable latex back on the carpet). If these conditions of thickness and favorable properties are not met, or equally important, if they are not maintained during service, it is obvious that no carpet, whatever the type, can do an effective sound-conditioning job.

In its booklet, "Sound Conditioning with Carpet," the American Carpet Institute readily admits that pile depth and density, as well as the type of backing material used, are vitally important in determining carpet's N.R.C. value, or sound-absorption efficiency. According to the ACI, the higher grade carpets with deep, dense pile construction are the most efficient. Similarly, starched backing materials or those made of latex are less effective from an acoustical standpoint than the higher cost grades. When pile and backing are of truly superior quality, N.R.C. values may range as high as .50 to .55, according to ACI figures.

Just what do these figures mean? Simply that *some* carpets today—notably those at the top of the price scale—can offer a measure of acoustical performance which barely places them in the category of a true acoustical material. This does not mean that *all* carpeting is in the same category. Actual job studies have shown that carpet is generally less than half as effective as conventional acoustical ceiling materials in controlling airborne noise.

This fact was borne out in a comprehensive study conducted recently by Rodman & Kunz at the Shaker High School near Albany, N. Y.

The carpeting for this school was not only selected and furnished free of charge by member companies of the American Carpet Institute, but the subsequent acoustical research was ACI sponsored. Initial N.R.C. values for the carpeting, as determined by Rodman & Kunz and reported in NOISE CONTROL Magazine (14), ranged from a high of .40 to a low of .35—considerably below the minimum requirement for an acoustical material. And even more significant, throughout the test period there was a consistent drop-off in absorption which researchers attributed to packing and soiling as a result of foot traffic.

(14) See Bibliography, Page 29

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